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(54) AN AUTOMATIC CERAMICS FORMING MACHINE

(71) We, TAKAHAMA KOGYO KABUSHIKI KAISHA, of 2-8, Horoku, Yoshihama-cho, Takahama City, Aichi Prefecture, Japan, A Japanese Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

10 This invention relates to an automatic ceramics forming machine, and to a method of automatically forming ceramics. The type of ceramic materials to which the invention is applicable are those such as porcelain and pottery.

15 Prior art ceramics forming machines, such as will be described later with reference to Figure 1, used a system of linkages and levers moved by cams. There are disadvantages in these prior art machines because the linkages used are arranged so as to bring the forming trowel into a single position for optimum forming of a ceramics article. Difficulties then arise on removing the trowel, because its orientation is such that it may tend to damage the finished article on withdrawal because the orientation cannot be altered from that in which the article is actually formed.

30 According to the present invention, there is provided an automatic ceramics forming machine comprising a mould holder, a forming trowel holder, a drive for rotating at least one of said holders about an axis passing through both holders, means for moving at least one of said holders towards and away from the other holder along said axis, a hydraulic piston-cylinder unit operating the means for moving, and a cam-operated drive controlling the flow of hydraulic fluid to the piston-cylinder unit.

40 The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

45 Figure 1 is a schematic diagram, partly in

section, of a known automatic ceramics forming machine,

Figure 2 is a side view, again partly in section, of a first embodiment of a ceramics forming machine according to the invention,

Figure 3 is a view corresponding to Figure 2, but showing a second embodiment of the invention, and

Figure 4 is a view of the machine shown in Figure 3 from the direction of the arrow X.

The prior art machine will be described first.

This machine has a mould D in which a ceramic article W is being formed by a forming trowel K. The forming trowel K is rotatable about a substantially vertical axis in the operating position, as indicated by the arrows shown above its axis. In addition, the mould holder is also rotatable about a vertical axis. The drives for these two rotations are not shown.

The forming trowel K is mounted at the end of an arm A pivoted at S. The opposite end of this arm A carries a cam follower roller R which rolls against a cam C mounted on a drive shaft for rotation in an anti-clockwise direction. The left-hand end of the arm A is weighted to keep the follower roller R in contact with the surface of the cam C. As the cam C rotates, the arm A will move up and down between the positions shown in solid lines and in chain dotted lines in Figure 1.

The direction of movement is shown by the arrow P-P'. The position shown in full lines is the operating position, and in the position shown in dotted lines, the forming trowel is completely out of the mould. It will be seen that as the trowel is lifted out the mould, due to the fact that the movement is not vertical but along an arc, there is a danger that the top edge of the moulded article may be chipped or otherwise damaged by the edge of the trowel.

Turning now to Figure 2, a mould holder

13 is carried on a shaft 12 journaled in bearings 10, 11. The shaft 12 is driven by a motor (not shown) for rotation about a vertical axis. A forming trowel 8 is mounted in a holder 9, and is also driven by a motor (not shown) about a vertical axis. The forming trowel with its holder can be moved vertically towards and away from the Mould D, as will now be described.

The trowel holder 9 is mounted by way of an arm 4 on a vertical support 3. The arm 4 slides along a vertical track in one face of the support 3 and is suspended from a piston rod 7. The piston rod 7 extends up into a piston-cylinder unit 6 through a shoulder 5 of the support 3. Hydraulic fluid inlet and outlet connections 28 and 30 are shown, and by pumping fluid into and out of these connections, the piston can be raised and lowered to move the trowel holder between the position shown in full lines and the position shown in dotted lines in Figures 2. The piston-cylinder unit 6 is therefore double-acting.

Hydraulic fluid is fed to the unit 6 through ducts 32 and 33. At their other ends, these ducts are connected to the connections 29 and 31 of a second piston-cylinder unit 24. This unit is also double-acting. A piston rod 25 attached to the piston of this unit 24 passes through an opening 26 and is connected to the end of an arm 17 of a cam-follower mechanism by a pivot 27.

This cam-follower mechanism is arranged in a housing portion 2 and consists of a double-cam wheel 22, 23 fixed on a rotating shaft 21. The cam-follower is a two-armed lever 15 having arms 17 and 19. The lever 15 is journaled at 16 to a bracket 14. Both of the arms 17 and 19 have respective cam-follower rollers 18 and 20. The two armed construction with the two cam discs is intended to ensure that the followers always remain in engagement with the cam surfaces.

When the shaft 21 rotates in the direction shown by the lower arrow within the housing portion 2, the follower roller 18 will be moved between the positions shown in bold and in dotted lines as it follows the cam surface. This will have the effect of moving the piston in the piston-cylinder unit 24 up and down, so that on a downward stroke hydraulic fluid is pumped through the duct 33 to the unit 6 and back along the duct 32, and on an upward stroke the fluid is pumped along the duct 32 and back through duct 33. The mechanism described will therefore produce a reciprocating motion of the forming trowel holder 9.

The machine shown in Figures 3 and 4 can make an additional movement. Here, the vertical support 38 is mounted via a pivot pin 37 on a bracket 36. A sideways acting piston-cylinder unit 41 is provided fixed to a vertical support 40 (see Figure 4) and actuation of this unit causes the support 38 to

move about a horizontal axis as shown by the arrows Q-Q'. This movement brings opposite sides of the forming trowel 8 into a vertical position.

The piston-cylinder unit 41 has two connections 42 and 43 for hydraulic fluid which can pass in either direction through either of the ducts 44 and 45. The piston-rod 46 passes through a hole 47 in the support 40 and is attached to the support 38 via a bracket 39.

Instead of the two-armed cam follower lever 15 shown in the drawings a single-armed cam-follower, drawn against the surface of the cam 22 by spring tension could be drawn. Alternatively, a grooved cam could be used.

The cam and follower mechanism may be placed apart from the rest of the machine, with just a mechanical linkage transmitting the motion produced by the cam to the piston cylinder unit 24.

The upper piston-cylinder unit 6 has bleeding valves 48, 48'.

To operate the machine, the hydraulic circuit between the units 6 and 24 is first filled with fluid and bled by means of the valves 48, 48' so that the system is completely filled with fluid. An appropriate forming trowel 8 is placed in the holder 9, and the necessary quantity of clay is put into the mould D. The mould is then rotated via the shaft 12. When the cam shaft 21 is turned at a low speed, the forming trowel is lowered into the mould. While this is happening the trowel 8 is rotating. Due to the rotation of the mould D, the clay is thrown in the mould to produce a product W.

Since the cam shaft 21 is continuing to rotate, the forming trowel will be withdrawn from the mould. Rotation is then stopped so that the product W can be removed from the mould D.

The way in which the movements of the forming trowel can be controlled in this invention makes it possible to produce a very fine or delicate product. Since the hydraulic system consists of only two interconnected cylinder units, the installation is very simple.

Instead of the type of forming trowel shown, a plate type trowel can also be used.

WHAT WE CLAIM IS:-

1. An automatic ceramics forming machine comprising a mould holder, a forming trowel holder, a drive for rotating at least one of said holders about an axis passing through both holders, means for moving at least one of said holders towards and away from the other holder along said axis, a hydraulic piston-cylinder unit operating the means for moving, and a cam operated drive controlling the flow of hydraulic fluid to the piston-cylinder unit.

2. A machine as claimed in claim 1, wherein both holders can be rotated about the axis.

3. A machine as claimed in claim 1 or claim 2, wherein a second piston-cylinder unit is controlled by the cam-operated drive, and a closed hydraulic fluid circuit is formed between the two units. 15
- 5 4. A machine as claimed in claim 3, wherein the piston of the second unit is connected to a cam follower following a cam on a drive shaft. 20
- 10 5. A machine as claimed in any preceding claim, wherein the forming trowel holder is reciprocable along a support, and the support is pivoted so as to be movable to either side of a vertical position. 25
6. A machine as claimed in claim 5, wherein a double acting piston-cylinder unit is provided to produce the pivoting movement of the support.
7. An automatic ceramics forming machine substantially as herein described with reference to Figure 2 or Figures 3 and 4 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
57-60 Lincoln's Inn Fields,
London, WC2A 3LS,
Agents for the Applicants.

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FIG. 1

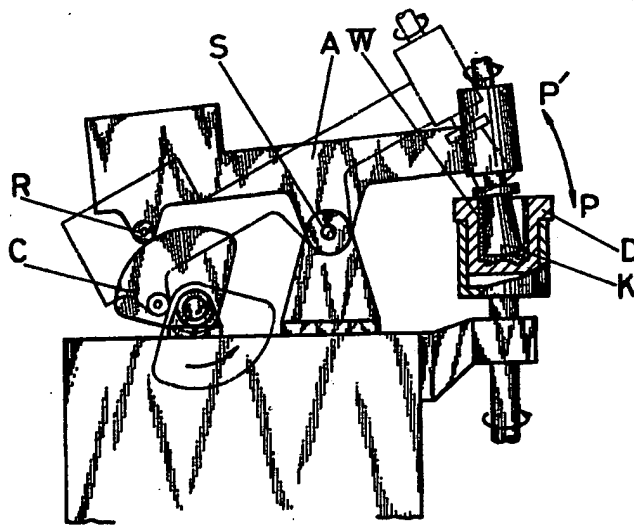
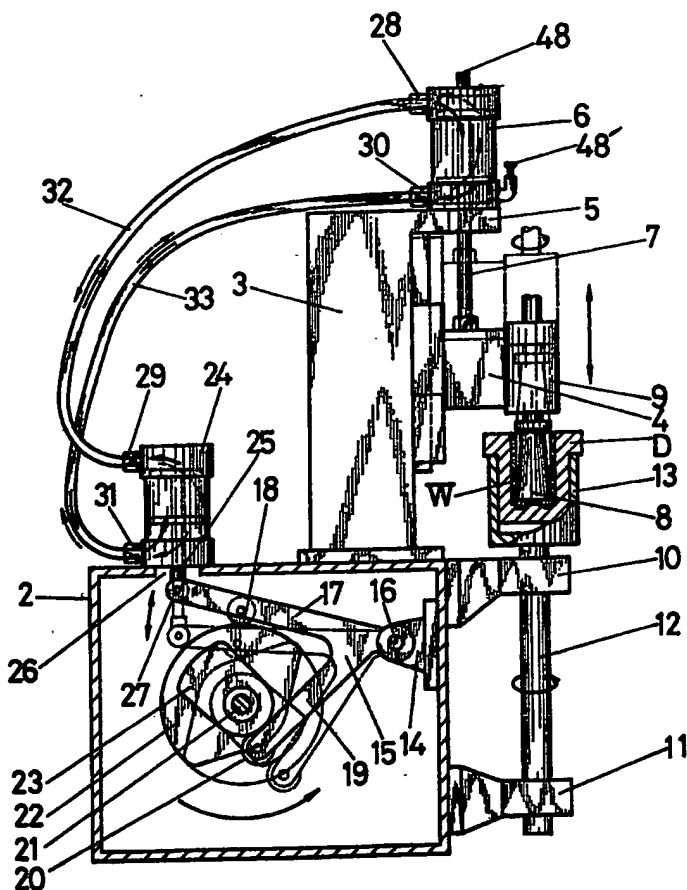


FIG. 2



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FIG. 4

